

Master's thesis II- MSc Economics

Lund University School of Economics and Management 2023

**Private and public quality of care- a comparison of
pressure sore prevalence in Swedish care homes**

by

Hedda Carlsson

Supervisor: Jan Bietenbeck

Abstract

This paper compares the quality of private and public health care, by studying Swedish care homes for elderly and disabled persons. The outcome of interest is the prevalence of pressure ulcers. Pressure ulcers are partly preventable by for example care home staff routines, nutrition and movement plans. As pressure sores is one of the most common healthcare injuries, comparisons of pressure sore prevalence between private and public nursing homes have been carried out previously. Prior studies generally show that pressure sore prevalence increases from private ownership, and that quality of care is lower for private nursing homes. This paper's contribution to the literature is the addition of a pressure sore risk measure, inclusion of 5 different types of care homes, evaluation of potential mechanisms and the use of the high coverage data from the Swedish quality registry Senior Alert. Data is gathered on care home-unit level for the years 2017-2022. A two-way fixed effects model is applied, and mediation analysis is performed. The general results entail that in Sweden, private ownership of care homes has a negative significant effect on pressure ulcer prevalence. These results are however not robust to exclusion of short-term homes, nor to running separate analyses for the different home types. For the analysis on nursing homes specifically, and for the restricted sample of municipalities in which no guaranteed choice of care home is given, the results are robust.

Acknowledgement: I want to direct the biggest thank you to my supervisor Jan Bietenbeck, whose advice and guidance has been invaluable throughout the process.

Abstract	2
1. Introduction	4
2. Background	5
2.1 Care homes in Sweden	5
2.2 Pressure sores	7
3. Previous literature	9
4. Data	12
4.1 Summary statistics.....	15
5. Empirical strategy	19
5.1 Identification strategy.....	19
3.2 Model specification	20
3.3 Assessment of potential selection and omitted variable bias	21
3.4 Robustness checks.....	21
3.5 Extended- and mediation analyses	22
3.6 Limitations	22
6. Results	23
6.1 Main results	23
6.2 Robustness checks.....	25
6.3 Extended dataset and mediation analyses	28
7. Discussion	30
8. Conclusion.....	33
References	35
Appendix	40

1. Introduction

Elderly care is an important and growing part of health care. In 2021, total costs of elderly care for Swedish municipalities peaked at 18.2 billion SEK. In the past ten years, the group of people above the age of 65 increased by approximately 275.000 individuals (SCB 2023). In the same period, the group of persons with disabilities grew by approximately 13.000 individuals (Socialstyrelsen 2023 1). As the group of elderly and disabled persons seem to grow, the importance of adequate care for these groups also increases. Following a shift in the Swedish municipality law in 1991, the care home market was opened up for private actors (Forsberg 2012). Today, 20% of all care home residents stay in a private home (Socialstyrelsen 2022 2). This has led to frequent debates about the quality of care in private care homes. Conflicting concerns that private actors' incentives of profit-making may put quality second, while public actors may lack incentives to react to demand shifts and improve efficiency have risen from this debate. Prior studies have different issues such as outcomes weakly connected to the quality of care and insufficient control variables describing initial health status of care home residents.

In this paper, I will study whether private or public care homes provide higher quality of care. I focus my analysis on pressure sores, a common complication from inadequate care which severely impacts patients' quality of life. The Swedish quality registry Senior Alert compiles data on pressure sore prevalence on care home-unit level for nearly all municipalities in Sweden, starting from 2017 (Senior Alert 2023 1). Additional interesting variables in the dataset include pressure sore risk of residents, largely important to explain pressure sore prevalence and examine potential selection of residents with differing initial health status between private and public units. The main explanatory variable is a dummy variable of private versus public. This variable is regressed on the share of residents with pressure sores in each care home-unit, with pressure sore risk as the main control variable. Municipality-and year-fixed effects are included, such that only within-municipality variation is evaluated and allowing for year-specific national trends.

The baseline results entail that private rule of care homes lead to lower rates of residents with pressure sores. The number of pressure sores per patient along with the share of residents with more severe pressure sores also decrease from private ownership. However, these results are not robust to all within-unit type comparisons. It is found that only private ownership of nursing homes

significantly lower pressure sore levels, whereas for all other within-home type analyses no significant difference prevails. The baseline results are also not robust to exclusion of short-term homes, the home type with the highest pressure sore levels. Lastly, the baseline results are robust to excluding the 26 municipalities which implemented the law of “freedom of choice system” (LOV). Potential mechanisms behind the results are studied in a mediation analysis, and it is found that the presence of unit meal routines and frequency of available group activities are significantly and substantially increased by private ownership. As these variables represent important preventive measures for pressure ulcers, it is in line with the medical literature that these variables could account for the share of the results which entail a negative effect of private ownership on pressure sore prevalence.

This paper continues as follows, first a background of care homes, their role and pressure sores. Second comes a review of previous literature on quality-of-care comparisons between private and public actors, mainly considering pressure ulcers in care homes. Next follows a data description of the Senior Alert register and additional data from the Swedish Social Services. Thereafter, the empirical strategy is specified and followed by presentation of the results. Lastly, the results are discussed, and a conclusion is drawn from the results of this paper.

2. Background

2.1 Care homes in Sweden

In Sweden, municipalities are responsible for elderly care and social services (SKR 2022). A distinction between two main categories of home care and care homes must be made. Home care entails that an individual can receive some assistance in their own home to facilitate everyday life, such as housework, personal hygiene and grocery shopping. If more extensive assistance is needed, a care home is more suitable. In a care home, the residents are offered similar assistance, but are in a facility in which there is a care team available around the clock. Commonly, it is educated nurses or assistance nurses who are available. Many care homes also have a permanent doctor contact for the residents (Socialstyrelsen 2016). For this essay, care homes are the focus due to the access to a care team and the consistency of the care as the residents live at the home around the clock. This

is deemed probable to have implications for the opportunities for prevention of pressure ulcers. Similar conditions of assistance are provided in a so-called “law of support for disabled persons” (LSS) home, but to a larger extent must be customized to the residents’ needs and health status (IVO 2022). The categories of care homes includes dementia homes, LSS homes, nursing homes, short-term homes and social psychiatry homes. Care homes operate on behalf of the municipalities, and therefore the municipality is responsible for evaluating individual applications for spots at a care home. After an evaluation is finished, the matter can be assigned to either a municipal facility, a private company or non-profit foundation.

Private and public facilities are covered by the same rules for inspection, which requires following the Swedish laws and is audited by the Swedish Health and Social Care Inspectorate (IVO) (Socialstyrelsen 2016). Although, to enter the care home sector private actors must undergo specific inspections contrary to municipal facilities. According to Swedish law, private actors wishing to enter the market of care homes, must undergo an inspection from IVO and receive a permit from the Social services (SFS 2001:453). This has been subject to discussion, as it puts differential requirements on the private homes compared to the public.

2.1.1 Selection into care homes

How elderly and disabled persons within a municipality sort into private versus public care homes is of importance for this analysis. The law of “freedom of choice system” (LOV) regulates whether individuals can choose care home unit themselves, or if it is decided by the municipality. For care homes, not many Swedish municipalities allow free choice according to LOV; exactly 27 out of 290 municipalities (Upphandlingsmyndigheten 2023). The years of implementation of LOV for care homes can differ between the type of home and is not available as a collected dataset but only as separate announcements. After a quick scan, many LOV implementations took place between 2020-2023. As for the remaining 269 municipalities, some degree of selection could still be expected due to the possibility to request care homes. Requests are allowed, however there is no guarantee that the requests are obliged.

No recent evaluation was found on whether elderly tend to submit choices and requests or not for care homes, nor for whether they tend to get allocated to the home of choice. More studies are available evaluating the situation in home care. A report from the Swedish Social Services

presented that in 2012, the active choice of home care was very rare in all LOV-municipalities but Stockholm. The report further compiled studies suggesting that the choice of a caregiver can be difficult for elderly and disabled as the available information may be difficult to get ahold of and evaluate, sometimes the patient may be in urgent need of assistance or in too bad shape to take an active decision. Several further studies entailed that few elderly shift facilities. Lastly, few spots are available in care homes and therefore applicants may feel under pressure to take the first offer they get (Socialstyrelsen 2012). A more recent publication, also from the Social Services, evaluated the situation of availability for care homes in Sweden and concluded that 109 municipalities had shortages of spots, 140 municipalities were in balance and approximately 30 had an excessive number of spots, 10 did not reply (Socialstyrelsen 2021). This might indicate that the number of available spots are often not abundant and therefore the applicants might have to take the care home spot they are offered. Due to the indication that many applicants, even in LOV-municipalities, cannot or do not choose their care homes and the fact that many LOV implementations took place in the later part of the period of this study, these municipalities are not removed from the sample entirely but as robustness checks. Potential selection issues are further evaluated in the empirical strategy section.

2.2 Pressure sores

Pressure ulcers can also be called pressure ulcers and bedsores. In this paper, pressure ulcers and pressure sores will be used interchangeably.

2.2.1 General information

Pressure sores are damages to the skin and underlying skin tissue. They are caused mainly by sustained pressure on the skin and develop gradually over time, but can sometimes develop in just a few hours (NHS 2020). Early symptoms of pressure sores are discoloration of the skin, along with pain or itchiness. These symptoms show at the early stages, and these sores are sometimes called category 1 pressure ulcers. Further, if a pressure ulcer gets worse, it can develop into successively more severe open wounds or blisters. As the wound goes deeper, the category of the wound shifts from category 1 to category 2, 3 and lastly 4, category 4 being the most severe (NHS 2020).

Risk factors for developing pressure sores are presented next. In general, mobility problems of different sorts are related to increased risk of pressure sores. People over the age of 70, those restrained to bed due to sickness or post-surgery and those with mobility problems due to medical conditions are some examples of risk groups due to mobility problems (NHS 2020). Elderly people also tend to have skin that is more easily damaged, which is a further risk factor for pressure sores. Malnourishment and poor diet are further factors increasing pressure ulcer risk (Bååth & Källman 2022 3). Lastly, medical conditions such as urinary incontinence and conditions affecting blood supply or skin fragility are further risk factors for obtaining pressure sores (NHS 2020).

2.2.2 Prevention and treatment

In hospitals or care homes, those with pressure ulcers or at risk of developing such should be monitored and offered advice and treatment. Methods for prevention of pressure ulcers include regular change of position, regular skin examinations and a healthy and balanced diet. If in a care home or hospital, the care team should carry out risk assessment, skin examinations and implement preventative measures. These measures include appropriate materials surrounding sensitive areas, assistance for a balanced diet and regular repositioning (NHS 2020). Some methods for treatment of pressure sores and promotion of the healing process are; using appropriate clothing and bedding materials, movement and regular shift of position, a balanced diet and a procedure to clean and treat existing wounds (NHS 2020). The routines for prevention and treatment are thereby quite similar. At the start of a period of care, such as the arrival to a care home, risk assessment for pressure ulcers shall be conducted, especially for risk group individuals (Bååth & Källman 1 2022). In most cases, pressure ulcers are preventable (Bååth & Källman 2 2022), and thereby, the care team at care homes plays an important role in prevention and treatment of pressure ulcers.

According to the Swedish social services, a pressure ulcer is to be counted as a “healthcare injury” if it could have been prevented by the care team taking appropriate measures against the ulcer (Socialstyrelsen 2022 1). According to an inspection carried out by the Swedish council of municipalities and regions (SKR), pressure ulcers represent around 8% of the total healthcare injuries in Sweden (Socialstyrelsen 2022 1). The measures included in municipality-wide plans to prevent pressure ulcers are often not carried out in practice (Senior Alert 2022). The partial preventability of pressure sores, the important role of the care team in prevention and treatment, and pressure sores’ status as a healthcare injury makes them an appropriate mode of examination

of the quality of care. It should however also be noted that sometimes, pressure sores can develop regardless of the quality of care (NHS 2020).

2.2.3 Costs of pressure ulcers

Pressure ulcers can induce severe physical, emotional and social suffering for the affected according to the Swedish social services. Further, they represent large costs for societies (Socialstyrelsen 2022 1). In a paper by Padula et al. (2011), it is estimated that pressure sore prevention is more cost efficient than standard treatment once a pressure sore has already formed. This entails that preventing a pressure sore saves money, compared to having to treat a wound that could have been prevented. Turning to how pressure sores affect the lives of the affected patients, measuring how quality of life is impacted is relevant. Quality-Adjusted Life Expectancy (QALE) is a measure frequently used to evaluate how different diseases and conditions may impact the quality of life for the affected. As life expectancy is not impacted by all medical conditions, the QALE-measure is an attempt to also take into account the magnitude of suffering from a certain condition. Therefore, it is suitable for evaluating how the quality of life is impacted for pressure sore patients. Padula et al. (2011) estimate that developing a pressure ulcer can decrease the QALE of a patient with 11.241 Quality-Adjusted Life Years (QALYs). This can also be considered the QALE effect of pressure ulcer prevention. As for the QALE effect of treatment after a pressure sore has already developed, treatment can increase QALE by 9.342 (Padula et al. 2011). Therefore, it is concluded that pressure sore prevention is both most cost efficient for care units, and most quality of life-improving for the affected patients.

3. Previous literature

In the following review of literature related to the topic, I first review some recent Swedish studies. Next, I discuss prior results from studies carried out specifically in a nursing home setting. Third, literature discussing the tradeoff between financial performance and quality of care is presented, along with a discussion of potential “cream-skimming” issues for private caregivers. Fourth, the components of outcome quality of care; input and process quality, are reviewed. Lastly, potential channels through which ownership status may impact quality of care are discussed. For clarification, private, public and nonprofit nursing homes are three different ownership statuses

explored in the literature. Since public nursing homes in Sweden are non-profitable by definition, comparisons between for-profit and non-profit care homes could to some extent proxy comparisons between private and public homes. Differences between nonprofit and public units are also subject to prior studies, but not included in this paper.

First off, prior evaluations of privatization and ownership status on the quality of care in Sweden are summarized. Bergman et al. (2016) evaluates the effect of privatization on quality of care using data from Swedish nursing homes from 1990-2009. They exploit the opening to private provision of circa 90 municipalities' elderly care services to evaluate the effects on mortality of the elderly population. It is found that municipalities which shift to private provision experience a comparative decline in mortality rates, while per-capita costs did not increase (Bergman et al. 2016). As the unit of observation is municipality, the sample size is small, exactly 276. The major issue of the paper is the use of mortality as outcome variable. Mortality rates may be impacted by endless factors, and the results could be caused by other simultaneous changes improving the health of elderly in the municipalities respectively. Furthermore, the outcome measures the mortality rate of the entire elderly population, whereas the treatment is only affecting elderly care. Another recent Swedish study by Knutsson & Tyrefors (2022) compares quality and efficiency of care for private versus public ambulances for the Stockholm region. They found that the post-ambulance treatment mortality is higher for patients who are treated by private ambulances, whereas efficiency is higher for the private ambulances (Knutsson & Tyrefors 2022). The same issue of using mortality rate as a quality of care outcome variable appears in this paper.

Second, studies comparing quality of care, including pressure sore prevalence, at nursing homes with different ownership status follows. Barron et al. (2017) concluded that for-profit nursing homes in England had lower Care of Quality Commission (CQC) inspection of quality ratings than nonprofit and public providers for a number of different measures (Barron et al. 2017). Grabowski & Hirth (2003) used data from U.S. nursing homes, including pressure sore prevalence, to compare the quality of care between nonprofit and for-profit homes. They found that nonprofit homes tend to have lower prevalence of pressure sores (Grabowski & Hirth 2003). A meta-analysis by Comondore et al. (2009) finds similar results of lower pressure sore prevalence for nonprofit nursing homes. Amirkhanyan et al. find that in the U.S, public and non-profit nursing homes perform better in terms of care quality and access compared to for-profit counterparts

(Amirkhanyan et al. 2008). Whereas most of these studies have very large sample sizes, the analyses do not contain any information on the status of residents as they arrive at the care homes, expected to impact for instance pressure sore prevalence.

In this section, the tradeoff between financial performance and providing high-quality care is discussed. Bos et al. (2017) conclude in a meta study that while for-profit nursing homes generally perform better financially, they also tend to perform worse in terms of client well-being compared to non-profit homes. Harrington et al. (2017) looked into the activities of nursing home chains in Canada, Norway, Sweden, United Kingdom and the United States, and concluded a pattern of high profit margins along with quality issues (Harrington et al. 2017). This emphasizes the tradeoff between economic performance and quality for all residents and further implies that when costs are cut, the group which requires most assistance might be most affected. In relation to this, a potential issue of private actors “cream-skimming” is brought up in a contemporary paper by Bos et al. (2020). In the Netherlands, for-profit actors can select their clients, whereas other actors such as public and nonprofit must accept clients referred to them. This could result in for-profit organizations only selecting clients who require limited assistance and healthcare, associated with lower costs (Bos et al. 2020). This cream-skimming issue is not an issue in the Swedish setting in the same manner, as it is the municipalities which evaluate care home applications and the possibility to choose is limited. Thereby, the private actors cannot pick and choose patients to ensure profitability. However, whether private actors should opt into certain care home sectors or not might be a “cream-skimming”-issue, this is evaluated later on in this paper.

The following section delves into a study by Chesteen et al. from 2005, evaluating the components of outcome quality of care, of vast importance for this study. The authors compare for-profit and nonprofit nursing homes and make a distinction between process- and input quality, which both impact the outcome quality of care. These components are often ignored in previous studies according to the authors. The input quality represents the degree of patient disability, whereas process quality is determined by the quality of care processes in a care unit. They find no difference in outcome quality between for-profit and nonprofit nursing homes, but that process quality is higher in non-profit homes whereas input quality is lower. One last finding is that process quality is more important for outcome quality (Chesteen et al. 2005). This study only uses data from one

year, which raises concerns of how time-specific effects may impact the results. However, I include input and process quality in the analyses in this paper, as suggested by the authors.

Lastly, some potential channels through which ownership status may impact the quality of care are reviewed. Bos et al. (2020) examine the recent emergence of the for-profit nursing home industry in the Netherlands and find that it can be partly explained by low responsiveness of the nonprofit sector to demand shifts. For-profit nursing homes were more responsive to the increased demand for “well-being approach”, emphasizing the importance of aspects such as food preparation and living environments rather than a traditional solely medical approach (Bos et al.2020). In terms of staffing levels, Bos et al. (2017) found that for-profit nursing homes tend to have lower staff to patient ratios, especially of direct care professionals. A meta-analysis from 2009 finds the same results of lower staffing levels in for-profit nursing homes (Comondore et al. 2009). These potential mechanisms are evaluated later on in mediation analyses, by inclusion of one meal routine variable along with several staffing level variables.

To conclude, no prior study has combined the features of a large sample representative of a large population, data from a relatively long time period, a variety of pressure ulcer variables and a pressure sore risk variable. The absence of variables representing initial health or pressure sore risk of residents cast doubt on whether the results from previous work is actually driven by differences in underlying health conditions. Additionally, this study also attempts to study potential channels of inference from inclusion of variables representing characteristics of care homes’ operations. Lastly, the previous literature often only considers nursing homes, whereas this study includes five different types of care homes for elderly and disabled persons which increases the generalizability of the results.

4. Data

I use data from the Swedish quality registry for care homes, the Senior Alert registry (2023 1). The registry was developed by the County Council of Jönköping, as a national web-based quality registry. One of their focus areas is pressure ulcers and their prevention (Edvinsson et al. 2015). The information in the registry is uploaded by staff from the care home units. This might be a source of bias, however, the Swedish Health and Social Care Inspectorate (IVO) carry out frequent

inspections at care homes which might decrease the probability of misreporting (Senior Alert 2022). The datasets from 2017-2022 are comparable, whereas the prior ones are not and therefore excluded from the sample. When the datasets are compiled, the unit of observation is care home-unit by year. The register summarizes data for six different types of care home units: 1) Nursing home, 2) Dementia home, 3) Short-term home, 4) LSS home, 5) Social psychiatry home and 6) Home care. According to the background section, home care is excluded from the analyses due to non-comparability. A few units are connected to regions rather than municipalities, which are potentially different to those connected to municipalities and therefore excluded. The datasets include data from 285 of the total 290 Swedish municipalities (Senior Alert 2023 1), within which the registry does contain information from the majority of the units.

The datasets include specification of which municipality each unit is connected to, the type of care home unit and the names of the “legal caregiver”. The names of the units are used to determine the ownership status of the care home, whether it is under private, public or non-profit foundation rule¹. The 213 units under non-profit foundation rule are excluded from analysis, since the public versus private comparison is of main interest in this analysis. This leaves a sample of 5532 care home unit-year observations, containing information on an annual average of 71341 individuals. Out of a total of approximately 88.000 individuals in care homes in 2021 (Socialstyrelsen 2022 2), the registry collected data for approximately 72.000 individuals (Senior Alert 2023 1). This entails a coverage rate of 81.8%. This is a very large population for which pressure sore prevalence and risk status is measured, which is a big advantage of this study even though the individual observations are collected measures. However, every single unit in every municipality is not covered, which could entail that the sample may not contain information from the care homes with the largest pressure ulcer problems. This is a potential limitation of this paper.

A dummy treatment variable Private [Private=1, Public=0] is constructed. The registry uses point prevalence measurements (PPM), in which the prevalence and values of different variables are collected at the same day of the year for all units. The dataset includes many different measures of pressure sore prevalence and their severity, along with some underlying characteristics of the care

¹ All units for which the names of “legal care provider” (juridisk vårdgivare) ended with “... municipality” were coded as public units, whereas all which ended with “...AB” were coded as private units. Out of the remaining units, all names were searched to determine whether they were public, private, or a non-profit foundation. This information was simple to gather from a simple web-browse and coded accordingly in the dataset.

home units and their residents. These variables are mainly presented in absolute numbers and are therefore divided by the number of residents in the units to acquire comparable measures. The main outcome variable is constructed as the share of total residents in a unit with at least one pressure sore. Furthermore, the average number of sores per resident and the share of residents with category 2-4 sores, the more severe ones, are constructed as two further outcome variables.

The control variables included in the main dataset are pressure sore risk, share of women and share of residents with a BMI < 22. One of the main advantages of this study compared to prior studies, is the “Risk of pressure sore” control variable from the Senior Alert dataset. This variable measures the share of admitted patients whom the care team deem at risk of developing pressure sores. It is measured according to the Norton Scale or Risk Assessment Pressure Sores (RAPS) method (Senior Alert 2023 2), which both include evaluation of risk factors such as physical condition, activity and mobility (AHRQ 2014, Lindgren et al. 2002). Inclusion of this control variable eliminates bias due to residents’ proneness to pressure sores, which otherwise may be an omitted variable driving the results. Further, many studies evaluate whether gender can impact the prevalence of pressure sores, and although some conclude no significant impact of gender on pressure sore prevalence (e.g., Coleman et al. 2013), some conclude that behaviors related to prevention may differ (e.g., Lichterfeld-Kottner et al. 2020). Malnutrition as an independent risk factor for pressure sore prevalence has been examined by for example Banks et al. (2010), who concluded that it indeed is a risk factor. The Senior Alert registry define underweight as BMI < 22, which is a key risk factor for malnourishment (Senior Alert 2023 3). Therefore, share of women and share of residents with BMI < 22 are included as control variables.

The annual care unit survey by the Swedish Social Services reports a wide variety of interesting information about Swedish dementia and nursing homes (Socialstyrelsen 2023 2). For example, whether the care home has a meal routine, the frequency of available group activities such as walks and physical activities, the share of adequately educated staff, nurses and staff per apartment are available in the dataset. The study was not published in 2020 and 2021 due to the pandemic mainly. Due to a mismatch of observation units to the main dataset from Senior Alert, the datasets were matched on aggregate private and public municipality-year level. This leaves 981 observations. Due to additional mismatches between the reported municipality names in the control variable dataset and the original dataset, Stockholm, Gothenburg and Malmö municipalities are excluded

from the extended analysis. The merged averages from both datasets were weighted by the number of patients, respectively the number of apartments from each dataset.

4.1 Summary statistics

Table 1: Summary statistics

	Public			Private		
	Mean	SD	N	Mean	SD	N
Share with pressure sore	.067	.097	3651	.054	.071	1881
Share with pressure sore risk	.299	.167	3651	.277	.148	1881
Share of female residents	.604	.182	3651	.651	.152	1881
Share with BMI < 22	.251	.149	3651	.310	.140	1881
Number of residents per unit	92.689	172.617	3651	47.656	56.405	1881
Sores per resident	.092	.160	3651	.070	.097	1881
Share with category 2-4 sore	.050	.108	3651	.042	.065	1881

Table 1- Summary of unweighted means, standard deviations and sample sizes from the Senior Alert datasets from 2017-2022. Unit-year level. Collected April 2023.

Table 1 summarizes means from the Senior Alert dataset. The total number of observations is 5532, of which approximately two thirds are public units and one third private units. The share of residents with pressure sores is vastly higher in the public units relative to private, whereas the share of residents with pressure sore risk is slightly higher in public units but very similar. That these averages are similar is a key indication that individuals at risk of developing pressure sores do not select into either private or public homes. The average share of residents with pressure sores for the total sample is 0.063, important for later interpretation of results. The average share of

residents with BMI < 22 is 0.310 in public units compared to 0.251 in public units. The average number of residents per unit differs largely between private and public units. The two additional pressure sore variables, sores per resident and share of residents with category 2-4 sores, are both higher in the public units similarly to the share with pressure sores.

Table 2- Summary statistics extended dataset

	Public			Private		
	Mean	SD	N	Mean	SD	N
Share with pressure sore	.068	.042	810	.058	.039	171
Share with pressure sore risk	.311	.080	810	.281	.083	171
Share of female residents	.654	.048	810	.672	.070	171
Share with BMI < 22	.245	.056	810	.300	.072	171
Sores per resident	.094	.068	810	.075	.056	171
Share with category 2-4 sore	.047	.031	810	.045	.039	171
Frequency of available group activities	4.024	.661	810	4.705	.514	171
Share of adequately educated staff	80.375	9.349	802	80.863	8.708	169
Nurses per apartment	.037	.015	771	.040	.018	163
Staff per apartment	.300	.052	798	.268	.053	169
Unit has implemented meal routine (Yes=1, No=0)	.271	.389	810	.791	.364	171

Table 2- Summary of unweighted means from the merged dataset of Senior Alert and the Swedish Social Services. Data from 2017-2019 and 2022. Municipality-year-private versus public level. Collected March 2023

Table 2 summarizes the means from the merged dataset between the Senior Alert dataset and the extension from Socialstyrelsen. Here, the number of observations, on municipality-year level divided between private or public, is 981 in total, of which now a smaller share of private units is

included in the dataset. The pressure sore outcome variables follow the same pattern as in Table 1; the means are higher in the public units than the private. The share with underweight BMI residents continues to be higher in the private units, along with the share of female residents. From here on, the remaining variables are unique to the extended dataset. The frequency of available group activities is higher in the private units than in the public ones, measured by a scale measure from 1-5. The share of adequately educated staff is similar in private and public units. Nurses per apartment is slightly higher in private units, whereas the staff members per apartment is higher in the public units. Lastly, the dummy of whether the unit has implemented a meal routine or not is substantially higher for private units. All these additional explanatory variables may be determined by the ownership status of a care home and can therefore be considered bad controls had they been included in the regressions. Therefore, they are not included in the regression analyses as control variables but are instead evaluated in a mediation analysis.

	Dementia	LSS	Nursing home	Short-term	Social psychiatry
Total	0.047	0.044	0.065	0.088	0.028

Table 3- Share of residents with pressure ulcers by care home type. Absolute numbers reported, observations on unit-year level. Data from the Senior Alert registry, from 2017-2022.

	Dementia	LSS	Nursing home	Short-term	Social psychiatry	Total
Public	754	371	1668	796	62	3651
Private	481	59	1227	78	36	1881
Total	1235	430	2895	874	98	5532

Table 4- Frequency of care home types' observations in the private and public sector respectively. Absolute numbers reported, observations on unit-year level. Data from the Senior Alert registry, from 2017-2022.

In Tables 3 and 4, the average pressure sore prevalence and composition of private and public units by care home category are presented. As the pressure sore prevalence and compositions of private and public homes differ vastly for different unit types, home type dummies should not be included

in the regressions due to potentially constituting bad controls. Instead, a robustness check of five separate analyses for the different unit types is conducted. Furthermore, as the short-term homes have a substantially higher share of residents with pressure ulcers than the other home types, and the home type is dominated by public homes, an additional robustness check excluding short term homes is conducted.

5. Empirical strategy

The aim of this analysis is to evaluate the potential causal effect of staying in a private nursing home compared to a public home on individuals' health. The ideal experiment to study this question would utilize individual-level data for all individuals in care homes in Sweden, from a relatively long time period. Allocation of individuals between private and public homes would be randomized. Lastly, care homes would be within the same legal entity and environment.

Here, limitations of available data restrict the evaluation, but are dealt with in various ways. Compilations of data from care home units which shall include all patients at the unit is as close to individual-level it is possible to get with public data in this setting. The initial health levels of residents are a concern in terms of random allocation, related to the notion of input quality from Chesteen et al. (2005). Although this cannot be fully measured, the pressure sore risk variable most importantly, along with the gender and BMI < 22 variable, account for some initial and underlying health characteristics. The pressure sore risk variable is very important as it contains information on pre-existing health conditions related specifically to the pressure sore outcome variable. The allocation of individuals between private and public facilities is expected to be largely random within municipalities, as the elderly often cannot or do not choose, or simply need to take the first open spot. Municipality-fixed effects are included to ensure that only units subject to the same local government, legal conditions and somewhat similar environmental conditions are compared.

5.1 Identification strategy

The key identification assumption of this paper is that accepted applicants are randomly allocated to private and public care home units within the municipality. The treatment and further control variables are assumed to be exogenous conditional on the municipality-fixed effects. This further entails that the treatment may be arbitrarily related to the municipality-fixed effects, suitable for this study. Within municipality-variation between care home-unit-year observations is utilized to evaluate the effects of ownership status on pressure sore prevalence. The pressure sore risk variable but also further controls relevant for underlying conditions are added to control for the initial health status of residents.

5.2 Model specification

To study the effect of ownership status on pressure ulcer prevalence in nursing homes, a model with share of residents with at least one pressure ulcer is regressed on a dummy variable of whether the home is privately (=1) or publicly owned (=0). Two additional dimensions of pressure ulcer prevalence are analyzed with two alternative outcome variables: 1) the average number of pressure ulcers per resident and 2) the share of residents with category 2-4 pressure ulcers. The control variables pressure sore risk, share of women and share of residents with BMI < 22 are added as these are not expected to be determined by the ownership status of the unit.

Heterogeneity between municipalities impacting elderly care can be expected based on factors such as policy, municipal budget, work procedures and routines, environmental factors as average humidity and temperature and elderly-population compilation. To ensure that the results are not driven by these effects, time-invariant heterogeneity between municipalities is eliminated through inclusion of municipality-fixed effects. To allow for serial correlation of standard errors within municipalities over time, standard errors are clustered at the municipal level. Further, trends over time could also be expected to influence the results through for instance the severity of specific seasonal flues, the intensity of the covid-19 pandemic, disease patterns or nation-wide legislative factors. These variables could to an extent be expected to vary over time on national level and therefore, time-fixed effects are also included in the model. Thus, a two-way fixed effects model is used for analyses, specified in Equation 1.

$$(1) \quad PU_{it} = \gamma_i + \beta_1 Priv_{it} + \beta_2 Risk_{it} + \beta_3 Female_{it} + \beta_4 BMI_{it} + \alpha_m + \lambda_t + \varepsilon_{it}$$

In Equation 1, the original model is specified. PU_{it} is the share of residents with pressure ulcers and $Priv_{it}$ is the ownership status of the care home. The subscript i stands for care home unit, and t for year of observation. The share of residents with pressure sore risk is measured by $Risk_{it}$, the share of female residents by $Female_{it}$ and the share of residents with BMI < 22 by the BMI_{it} variable. The municipality-fixed effects by α_m and the year-fixed effects by λ_t . The β_1 is the parameter of interest as it measures the treatment effect, in this case the Average Treatment Effect (ATE).

5.3 Assessment of potential selection and omitted variable bias

I expect a large degree of randomness in the allocation to private versus public care homes since it seems like few elderlies choose their caregiver, elaborated in the background section. However, due to the lack of complete insight to the selection process, some evaluation of potential selection in the allocation process is useful. For this evaluation the relative degree of selection on observables and unobservables (δ) is included in the analysis, following Emily Oster's methodology (2016). The intuition behind this approach is that based on how the treatment effect β_1 and the R-squared shift from inclusion of observable control variables to a given model, δ gives an estimate of how important the unobservables must be relative to the observables to drive β_1 to zero. This entails that if $\delta > 1$, the unobservables are more important for obtaining the true estimate of β_1 than the observables, and thereby have larger explanatory power of the treatment than the included controls. Equal selection occurs when $\delta = 1$, and when $\delta < 1$ the observables are more important for driving the treatment effect to zero. Oster suggests an upper bound for δ of 1, since when $\delta > 1$, the results are likely to be driven by selection on unobservable omitted variables. The suggested lower bound is zero (Oster 2016). Calculation of δ for the main analyses offers an alternative approach to study potential endogeneity due to selection and omitted variables. Another important discussion from the same paper by Oster, is that of R_{\max} , the highest possible R-squared that could be achieved in a model containing all observables and unobservables. Oster suggests that often, an $R_{\max} = 1$ is often not attainable, for example if a model suffers from any measurement error in the outcome (Oster 2016). Whereas potential R_{\max} values will not be calculated in this paper, the intuition will be important for discussion.

5.4 Robustness checks

A number of robustness checks are conducted. The first two are 1) excluding 2020 and 2021 observations, to evaluate whether potential higher pressure in either sector during the covid-19 pandemic could be driving the results, and 2) excluding the 27 LOV-municipalities, motivated in the background section, from the sample. The second robustness check is to run the results for each unit type separately. Furthermore, if interesting differences are found, the first two robustness checks may be conducted on a new limited sample. Lastly, a robustness check of the baseline and robustness analyses excluding short-term homes is conducted, motivated in the data section.

5.5 Extended- and mediation analyses

In the extended merged dataset, the unit of observation is private versus public aggregated on municipality level. Thereby, variation over time between the public and private sector on municipal level is utilized. The regression includes municipality-fixed effects, both with and without controls. To examine the potential channels through which ownership status may or may not influence pressure sore prevalence, a mediation analysis is conducted. Therefore, five variables expected to be related to pressure sore prevention, but potentially determined by the ownership status of the care home, are used as outcomes in a regression on private ownership. This can give some insight to whether the ownership status of a care home explains differences in these variables and enable evaluation of process quality as from Chesteen et al. (2005).

5.6 Limitations

In this paper, it is the preventable part of pressure ulcers which is of interest. Pressure ulcers are as discussed in the background section only preventable to an extent. Therefore, any model could not be expected to explain pressure ulcer prevalence in its entirety, which limits the explanatory power from any model on pressure ulcer prevalence. One limitation of this paper is that the Senior Alert dataset does not contain information on exactly all care home units in Sweden. The datasets capture around 82% of all residents at care homes around Sweden, the vast majority. However, it is possible that the remaining 18% are the worst in terms of pressure sores, and that the differences between public and private may be larger or different for this group. While this might be the case, the wide coverage of the registry imply that the results represent the larger picture.

A further potential confounding factor is care home spending and budget. If either private or public care homes have an advantage in terms of budget, which can be used to finance nutritious food, mattresses, clothing and sheet materials suitable for prevention of pressure sores, this could drive differences in pressure sore prevalence. The municipality payouts per resident are the same for private and public units, which may limit this impact to some extent. Although, since private actors may have additional budget due to investments and financial capital, the issue may remain. Lastly, the estimated care team time per patient is a further potential confounding factor, as available staffing level measures used here do not fully capture the duration of each patient meeting. These aspects would be interesting for future studies and were not included in this study due to data limitations.

6. Results

6.1 Main results

TABLE 5: Pressure sore results- Unit-year level

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Share with pressure sores	Share with pressure sores	Sores per resident	Sores per resident	Share with category 2-4 sores	Share with category 2-4 sores
Private	-0.018*** (0.007)	-0.015** (0.006)	-0.030*** (0.008)	-0.025*** (0.008)	-0.019*** (0.007)	-0.017** (0.007)
Share with pressure sore risk		0.117*** (0.026)		0.179*** (0.042)		0.106*** (0.032)
Share women		-0.013 (0.020)		-0.029 (0.030)		-0.001 (0.020)
Share with BMI < 22		0.019 (0.026)		0.017 (0.041)		0.011 (0.030)
Constant	0.066*** (0.003)	0.034* (0.018)	0.090*** (0.004)	0.050* (0.025)	0.050*** (0.003)	0.016 (0.020)
Observations	5,532	5,532	5,532	5,532	5,532	5,532
R-squared	0.008	0.052	0.008	0.049	0.007	0.036
Number of municipalities	285	285	285	285	285	285
δ (Oster's relative selection)	-	0.222	-	0.194	-	0.183
Municipality FE:s	YES	YES	YES	YES	YES	YES
Year FE:s	YES	YES	YES	YES	YES	YES

Table 5- Pressure sore prevalence results. Outcome variables specified in column titles, analysis on unit-year level. Baseline regressions specified in column 1 & 2. Municipality-and year fixed effects included. Datasets from the Senior Alert registry 2017-2022. Clustered standard errors by municipality in parentheses *** p<0.01, ** p<0.05, * p<0.1.

The main results are presented in Table 5. Private ownership has a significant negative effect on the share of residents with pressure ulcers in all six analyses, at the 5% level with and without controls. It should be highlighted that while the effect in absolute terms is negative, it is really positive in the sense that pressure ulcer prevalence decreases. The baseline analyses are presented in column 1 and 2. Private ownership of a unit induces an uncontrolled 1.8 percentage point decrease in the share of residents with pressure sores, and a controlled 1.5 percentage point decrease. This baseline negative effect of 1.5 percentage points can be considered large as the mean for this variable is 6.3%, as calculated from Table 1. For sores per resident in column 3 and 4, similar effects are found. The controlled effect of private ownership has a negative effect of 2.5 percentage points on pressure ulcers. Lastly, columns 5 and 6 display the share of residents with category 2-4 pressure sores, and these effects are similar to the results from the baseline analysis. The share of residents with pressure sore risk has a significant positive effect on all three pressure sore outcomes on the 1% level. A 1 percentage point increase in the share of residents with pressure sore risk induces a 10.6-17.9 percentage point increase in the pressure ulcer outcome variables, which can be considered a strong effect. Further, the share of women and the share with BMI < 22 have no significant effects on the outcomes.

Moving on, the explanatory power and relative selection analyses are evaluated. All R-squares displayed are the within R-squares, in other words how much of the within-municipality variation in the outcomes are explained by the model. The R-squares from the uncontrolled models are very low at 0.007-0.008, however significantly increase from the inclusion of controls to 0.036-0.052. Further, the relative selection coefficients range between 0.183-0.222, which entails that the observables are more important for driving the treatment effect towards zero than the unobservables.

Table A1 of the Appendix presents the results from robustness checks of the baseline analysis from column 1 & 2 of Table 5. The first two columns exclude the years of the covid-19 pandemic, 2020 and 2021, which results in similar results but of slightly smaller magnitude. Column 3 and 4 presents the results from analyses excluding the 26 LOV-municipalities. These results show that the magnitude of the effect increases slightly. The R-squared in column 1 & 2 remains exactly the same, whereas the R-squared in column 4 increases substantially, from 0.052 to 0.060.

6.2 Robustness checks

TABLE 6: Robustness checks- Pressure sores within unit type

VARIABLES	(1) Dementia	(2) Dementia	(3) LSS	(4) LSS	(5) Nursing home	(6) Nursing home	(7) Short- term	(8) Short- term	(9) Social psychiatry	(10) Social psychiatry
Private	-0.003 (0.007)	0.001 (0.007)	-0.096** (0.039)	-0.070 (0.053)	-0.013** (0.006)	-0.013** (0.006)	-0.077 (0.110)	-0.078 (0.108)	-0.004 (0.017)	-0.128 (0.173)
Share with pressure sore risk		0.060*** (0.020)		0.166* (0.095)		0.077** (0.037)		0.092* (0.049)		0.554* (0.300)
Share women		0.044** (0.019)		0.128 (0.083)		0.015 (0.038)		-0.060 (0.046)		0.047 (0.163)
Share with BMI < 22		0.001 (0.027)		-0.164* (0.097)		0.102** (0.049)		-0.030 (0.052)		-0.095 (0.229)
Constant	0.046*** (0.004)	-0.004 (0.014)	0.050*** (0.009)	-0.020 (0.047)	0.071*** (0.003)	0.010 (0.036)	0.089*** (0.010)	0.100*** (0.032)	0.009 (0.010)	-0.031 (0.104)
Observations	1,235	1,235	430	430	2,895	2,895	874	874	98	98
R-squared	0.014	0.047	0.089	0.287	0.012	0.056	0.014	0.039	0.126	0.440
Number of municipalities	158	158	85	85	285	285	180	180	21	21
Municipality FE:s	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE:s	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 6- Pressure sore prevalence results within care home category, specified in column titles. Outcome variable “share of residents with pressure sores”, analysis on unit-year level. Municipality-and year fixed effects included. Datasets from the Senior Alert registry 2017-2022. Clustered standard errors by municipality in parentheses *** p<0.01, ** p<0.05, * p<0.1

TABLE 7: Robustness checks- Excluding short-term homes

VARIABLES	(1) Share with pressure sores	(2) Share with pressure sores
Private	-0.007 (0.005)	-0.005 (0.005)
Share with pressure sore risk		0.108*** (0.028)
Share women		0.033 (0.021)
Share with BMI < 22		0.022 (0.031)
Constant	0.059*** (0.003)	-0.013 (0.019)
Observations	4,658	4,658
R-squared	0.004	0.080
Number of municipalities	285	285
δ (Oster's relative selection)	-	0.023
Municipality FE:s	YES	YES
Year FE:s	YES	YES

Table 7- Robustness checks results, outcome variable “share of residents with pressure sores”. Analysis on unit-year level, excluding 874 short-term care home observations. Municipality-and year fixed effects included. Dataset from the Senior Alert registry from 2017-2022. Clustered standard errors by municipality in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 6 shows the results of the robustness check of within-care home type analyses. Within the different care home types, the same negative significant effect of private ownership after including controls is only observed for nursing homes in column 5 & 6. In the nursing home analysis, the share of residents with a BMI < 22 now has a positive significant effect on the outcome. The majority of the total care homes are nursing homes, and therefore it is not surprising that they drive the overall results. Something of further interest is that there is no significant difference between the share of residents with pressure ulcers in the short-term home category, since this home type showed to have the highest shares of residents with pressure ulcers in Table 3.

Some further evaluations are made within the nursing home category, robustness checks of excluding the covid-19 pandemic years and LOV-municipalities presented in Table A2 in the appendix. For the exclusion of pandemic years in column 1 & 2, the coefficient on private ownership increases marginally compared to the baseline results. For the analyses excluding the LOV-municipalities on the other hand, the magnitude of the coefficients increases substantially, to a negative 2.3 percentage points for the controlled regression.

In Table 7, the results from the robustness check excluding all 874 short-term home observations are displayed. While the explanatory power of the model including controls increases, the effect of private ownership on pressure ulcer outcomes is no longer statistically significant in any of the analyses. To evaluate this further, robustness checks excluding the pandemic years and LOV-municipalities are conducted, results summarized in Table A3 of the appendix. The exclusion of the pandemic years does not change the results; however, the exclusion of LOV-municipalities results in a shift from insignificant to significant effects of private ownership on pressure ulcer prevalence at the 5% level. The magnitude of these coefficients is smaller than in the other two analyses removing the LOV-municipalities.

6.3 Extended dataset and mediation analyses

TABLE 8: Pressure sore results - Extended dataset

VARIABLES	(1) Share with pressure sores	(2) Share with pressure sores
Private	-0.013** (0.005)	-0.014*** (0.005)
Share with pressure sore risk		0.084** (0.035)
Share women		-0.002 (0.047)
Share with BMI < 22		0.057 (0.037)
Constant	0.063*** (0.003)	0.024 (0.033)
Observations	981	981
R-squared	0.076	0.110
Number of municipalities	252	252
δ (Oster's relative selection)	-	1.065
Municipality FE:s	YES	YES
Year FE:s	YES	YES

Table 8- Pressure sore prevalence results. Analysis on private versus public on municipality-year level. Municipality-and year fixed effects included. Dataset merged from the Senior Alert registry and the Swedish Social Service healthcare unit surveys, from 2017-2019 and 2022. Clustered standard errors by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

TABLE 9: Mediating variables- Extended dataset

VARIABLES	(1) Share of homes with meal routine	(2) Share of adequately educated staff	(3) Nr of nurses per apartment	(4) Nr of staff per apartment	(5) Nr of available group activities per week
Private	0.295*** (0.051)	0.589 (1.020)	0.005** (0.002)	-0.018*** (0.007)	0.349*** (0.068)
Constant	0.231*** (0.023)	76.775*** (0.671)	0.039*** (0.001)	0.298*** (0.004)	3.692*** (0.050)
Observations	973	971	932	967	981
R-squared	0.108	0.056	0.030	0.018	0.207
Number of municipalities	252	252	252	252	252
Municipality FE:s	YES	YES	YES	YES	YES
Year FE:s	YES	YES	YES	YES	YES

Table 9- Mediation analyses results, outcome variables specified in column titles. Analysis on private versus public on municipality-year level. Municipality-and year fixed effects included. Dataset merged from the Senior Alert registry and the Swedish Social Service healthcare unit surveys, from 2017-2019 and 2022. Clustered standard errors by municipality in parentheses *** p<0.01, ** p<0.05, * p<0.1.

In Table 8, the baseline analysis is conducted for the extended merged dataset from Senior Alert and Socialstyrelsen. In both columns, private ownership has a negative significant effect of 1.3-1.4 percentage points at the 5% level, similar to the baseline results. Studying the R-squared for this analysis, it is high compared to in the original analysis; an uncontrolled value of 0.076 and a controlled value of 0.110. However, the relative selection coefficient of the analysis in column 2 has a value of 1.065, which entails that the results are likely to be driven a bit more by unobservable selection than observable.

In Table 9, variables from the extended dataset which would be considered bad controls if included in the pressure sore regressions are used as outcomes in regressions on ownership status. As seen from the number of observations, data is missing for some municipalities for different variables. The share of homes with meal routines, the number of nurses per apartment and the number of available group activities per week all seem to be significantly positively impacted by private

ownership . Out of these three, the share of homes with meal routines has a high R-squared at 0.108, and the number of available activities per week has an even higher at 0.207. Both of these results are significant at the 1% level. The number of nurses per apartment is significantly positively impacted by private ownership at the 5% level, with a lower R-squared of 0.030. The number of staff members per apartment is significantly negatively impacted by private ownership, significant at the 1% level. Lastly, the share of educated staff is not significantly impacted by ownership status.

7. Discussion

The main results indicate that private ownership decreases the share of residents with pressure sores of a care home. This effect can be interpreted as that an applicant for a care home may leap a larger risk of developing pressure sores if allocated to a public home, due to some shortfalls in the care process. The size of the effects at -1.5 percentage points is also large considering that the mean share of residents with pressure ulcers is 6.3%. The size of the effect of private ownership on severity and frequency of pressure ulcers seem to be slightly larger than for the share of residents with pressure ulcers. However, considering the results from the robustness checks, the results cannot be considered robust overall.

The share of residents with pressure sore risk serves as an important control variable, significant at the 5% level in the vast majority of the regressions. This highlights the importance of including one or several variables which measure the health status of residents as they move into the care home, the input quality. Further, from the results in Table 1 and 2, it seems that the input quality is slightly higher in the private sector, which may leave the public units at a disadvantage. The share of women has no significant effects on the pressure ulcer prevalence throughout the different specifications. The BMI < 22 variable does not have a significant effect on the outcomes except for in the analysis within the nursing home category. One potential reason for this could be that the underweight or malnourished residents may also have other pressure ulcer risk characteristics, and therefore this effect is captured by the pressure sore risk variable.

Lastly, the relative degree of selection on observables to unobservables δ is generally low, which is a good indication that the treatment effect is not the result of selection on unobservables. Instead,

observables seem to be relatively more important for explaining away the treatment effect in this model. The one exception is the coefficient in column 2 of Table 8, in which the δ -coefficient is 1.065. However, since this analysis is included in order to ensure that the merged dataset is appropriate for studying mediating variables, not to draw conclusions on the treatment effect, this does not undermine the overall results. The R-squared values of the models are generally quite low, but as the part of pressure ulcer prevalence expected to be captured by any model is likely not 100%, in other words the expected value of R_{\max} is not 1 as discussed in the empirical strategy section, this does not necessarily undermine the importance of the results. What exactly the R_{\max} could be in this setting remains unanswered in this paper.

Moving on to robustness checks, the exclusion of short-term homes challenges the original results. Only the results from the analysis excluding the LOV-municipalities are similar to those from the baseline regression. The main results are also not robust to the individual home type analyses, except to the one for nursing homes only. The two analyses to which the original results are robust are the within-nursing home and excluding LOV-municipalities regressions. Nursing homes is the only care home category for which the effect of ownership status remains significant throughout all analyses. This suggests that it might be mainly for nursing homes that private ownership has a negative impact on pressure ulcers, which again is really positive as ulcers decrease. No differential effect of the pandemic on private and public homes seem to impact the results. Lastly, the results from the analyses excluding the LOV-municipalities all exhibit negative significant effects of private ownership on the share of residents with pressure sores at the 5% level. Out of the analyses excluding short-term homes, this is the only one in which the effect of private ownership is significantly negative, suggest that these municipalities may actually differ to the rest of the sample. This might indicate that in the LOV-municipalities, residents in worse shape not captured by the pressure sore risk examination choose to go to private care homes to a larger extent. Thereby, inclusion of these municipalities will bias the coefficient upwards, towards zero. This is also supported by the increase in magnitude of the treatment effect due to exclusion of LOV-municipalities.

The results of significant negative effects or no effects of private ownership contrast to previous results, which generally show that public or nonprofit nursing homes supply higher quality of care and would entail positive treatment effects in this study. Potential reasons for this are differences

in process quality, capital or differential requirements, all discussed further in the section on mechanisms. Another interesting aspect of the fact that results for only nursing homes compared to those including the whole sample differ, may indicate that the prior studies on nursing homes solely are not generalizable to other types of care homes. Suggestions for future research is to further focus on the other categories of care homes individually, to increase the knowledge on what mechanisms might be at play in care homes beyond nursing homes.

As for the channels through which ownership status may impact pressure ulcer prevalence, the results from the mediation analysis in Table 9 tell a story in line with known risk factors and previous literature. As the results from Table 8 are similar to those of Table 5, the extended dataset is considered a feasible proxy for the main dataset. Private ownership seems to have a large positive impact on the share of homes which implemented a meal routine along with the frequency of available group activities. Results for staffing levels are more inconclusive. As nutrition is an important part of pressure ulcer prevention, this may very well be an important difference between private and public care homes, important to consider and evaluate mainly for public homes. In terms of the frequency of group activities, this might positively impact the movement of the resident. Although some activities take place at the care home, just getting up for a little bit might be important to prevent pressure ulcers. This also seems to be a large difference between private and public homes. Both of these findings are in line with the findings from Bos et al. (2020) from the Netherlands, that private actors have moved away from a strict medical approach to a more inclusive “well-being” approach. The “well-being” approach thereby seems to have positive spillovers on pressure sore prevention. In conclusion, it seems that the process quality is higher at the private units compared to the public. One potential reason for the higher process quality of private care homes is that they might have an increased budget from private investors. This could induce an increased possibility to purchase appropriate mattresses and clothing for pressure sore prevention. Although, it should be underlined that this is rather speculative, and not results from this paper. Another potential reason is the fact that the private care homes actually have higher requirements to be able to open compared to public homes. As this is something we know is the case, this is a likely explanation.

In relation to the prior evidence of private units prioritizing financial performance over quality of care, this paper finds no evidence of this. No indication of cream-skimming of residents is found,

as expected due to the organization of the application and allocation to Swedish care homes. Despite this, the fact that short-term homes are predominantly publicly owned may indicate some degree of cream-skimming. As these care homes have the highest average share of residents with pressure ulcers, the tendency of private actors' preference to enter other more profitable care home markets seems to be one example of cream-skimming.

Considering the costs of pressure ulcers, both in terms of patient life quality and caregiver expenses, it is important to maintain or improve pressure sore prevention routines. As the costs of prevention is smaller than those of treatment, and the quality-of-life improvements are larger, preventions should be promoted. That the Quality-Adjusted Life Expectancy of residents at a care home can increase by 11 from implementation of preventative measures such as increased focus on nutrition and mobility along with appropriate mattresses and materials, emphasizes their importance. With these costs in mind, the findings from the report from Senior Alert that intended preventative measures are often not implemented must be taken seriously. Although the results from this paper are not sufficient to draw definite conclusions, the results from the mediation analyses indicate that the public sector could learn something from the private sector, and that a "well-being" approach may have far-reaching benefits.

8. Conclusion

In conclusion, private ownership of Swedish care homes seems to either have a negative effect on pressure sore prevalence, or no effect at all. The original results and the robustness checks of within-nursing homes and excluding LOV-municipalities entail a negative effect, whereas the other robustness checks of within-home type and excluding short-term homes indicate no significant effect. This is not in line with previous research, which mainly concludes a positive effect of increasing pressure sore prevalence from private ownership. The pressure sore risk variable accounts for important differences in initial health status of residents as they move into care homes. Since this or a similar variable is not included in previous studies, their results may be biased from the residents' initial health status. The main channels through which private ownership seems to impact pressure sore prevalence are more frequently adopted meal routines and available group activities. This is in line with the previous finding that private facilities tend

to have more of a “well-being” approach than a simple medical approach, and suggests this approach to be applied more widely also for public care homes.

References

Agency for Healthcare Research and Quality (AHRQ) 2014, Rockville, MD. Section 7. Tools and Resources (continued). Content last reviewed October 2014.

<https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7b.html>

Amirkhanyan, A.A., Kim, H.J. and Lambright, K.T. (2008), Does the public sector outperform the nonprofit and for-profit sectors? Evidence from a national panel study on nursing home quality and access. *J. Pol. Anal. Manage.*, 27: 326-353. <https://doi.org/10.1002/pam.20327>

Banks M, Bauer J, Graves N, Ash S (2010). Malnutrition and pressure ulcer risk in adults in Australian health care facilities. *Nutrition*. 2010 Sep;26(9):896-901.

<https://pubmed.ncbi.nlm.nih.gov/20018484/>

Barron, D.N. & West, E. (2017). The quasi-market for adult residential care in the UK: Do for-profit, not-for-profit or public sector residential care and nursing homes provide better quality care?, *Social Science & Medicine*, Volume 179, 2017, Pages 137-146, <https://doi.org/10.1016/j.socscimed.2017.02.037>.

Bergman M.A., Johansson P., Lundberg S., Spagnolo G. (2016). Privatization and quality: Evidence from elderly care in Sweden, *Journal of Health Economics*, Volume 49, 2016, Pages 109-119. <https://doi.org/10.1016/j.jhealeco.2016.06.010>.

Bos, A., Boselie, P., & Trappenburg, M. (2017). Financial performance, employee well-being, and client well-being in for-profit and not-for-profit nursing homes: A systematic review. *Health Care Management Review*, 42(4), 352–368. <https://www.jstor.org/stable/48516386>

Bos A, Kruse FM, Jeurissen PPT (2020). For-Profit Nursing Homes in the Netherlands: What Factors Explain Their Rise? *International Journal of Health Services*. 2020;50(4):431-443. <https://doi.org/10.1177/0020731420915658>

Bååth, C. & Källman, U. (2022) 1. Trycksår- Riskbedömning, Vårdhandboken.

<https://www.vardhandboken.se/vard-och-behandling/hud-och-sar/trycksar/riskbedomning/>

Bååth, C. & Källman, U. (2022) 2. Trycksår- Mäta för att veta, Vårdhandboken.

<https://www.vardhandboken.se/vard-och-behandling/hud-och-sar/trycksar/mata-for-att-veta/>

Bååth, C. & Källman, U. (2022) 3. Trycksår- Riskfaktorer och vårdrelaterade riskmoment, Vårdhandboken.

<https://www.vardhandboken.se/vard-och-behandling/hud-och-sar/trycksar/riskbedomning/>

Chesteen S, Helgheim B, Randall T and Wardell D. (2005). Comparing quality of care in non-profit and for-profit nursing homes: a process perspective, Journal of Operations Management, Volume 23, Issue 2, Pages 229-242, <https://doi.org/10.1016/j.jom.2004.08.004>.

Coleman S, Gorecki C, Nelson EA, Closs SJ, Defloor T, Halfens R, Farrin A, Brown J, Schoonhoven L, Nixon J (2013). Patient risk factors for pressure ulcer development: Systematic review, International Journal of Nursing Studies, Volume 50, Issue 7, 2013, Pages 974-1003, <https://doi.org/10.1016/j.ijnurstu.2012.11.019>.

Comondore V R, Devereaux P J, Zhou Q, Stone S B, Busse J W, Ravindran N C et al. (2009). Quality of care in for-profit and not-for-profit nursing homes: systematic review and meta-analysis BMJ 2009; 339 :b2732. <https://doi.org/10.1136/bmj.b2732>

Edvinsson J, Rahm M, Trinks A, Höglund PJ. Senior alert: a quality registry to support a standardized, structured, and systematic preventive care process for older adults. Qual Manag Health Care. 2015 Apr-Jun;24(2):96-101. <https://pubmed.ncbi.nlm.nih.gov/25830619/>

Forsberg, Ingrid (2012). Privatiserad äldreomsorg ger inte bättre kvalitet, Sveriges Radio (SR), Medicin & Hälsa. Published 13-02-2012. <https://sverigesradio.se/artikel/4908136>

Grabowski D.C. and Hirth R.A, (2003). Competitive spillovers across non-profit and for-profit nursing homes, *Journal of Health Economics*, Volume 22, Issue 1, 2003, Pages 1-22. [https://doi.org/10.1016/S0167-6296\(02\)00093-0](https://doi.org/10.1016/S0167-6296(02)00093-0).

Harrington C, Jacobsen FF, Panos J, Pollock A, Sutaria S, Szebehely M. (2017). Marketization in Long-Term Care: A Cross-Country Comparison of Large For-Profit Nursing Home Chains. *Health Services Insights*. 2017;10. <https://doi.org/10.1177/1178632917710533>

Knutsson & Tyrefors (2022). The Quality and Efficiency of Public and Private Firms: Evidence from Ambulance Services. *The Quarterly Journal of Economics* (2022), 1–50. <https://doi.org/10.1093/qje/qjac014>.

Lichterfeld-Kottner A, Lahmann N, Kottner J (2020). Sex-specific differences in prevention and treatment of institutional-acquired pressure ulcers in hospitals and nursing homes, *Journal of Tissue Viability*, Volume 29, Issue 3, 2020, Pages 204-210, <https://doi.org/10.1016/j.jtv.2020.05.001>.

Lindgren M, Unosson M, Krantz AM, Ek AC (2002). A risk assessment scale for the prediction of pressure sore development: reliability and validity. *J Adv Nurs*. 2002 Apr;38(2):190-9. <https://doi.org/10.1046/j.1365-2648.2002.02163.x>

National Health Service (NHS) UK (2020). Pressure sore overview. Last reviewed 15-04-2020. <https://www.nhs.uk/conditions/pressure-sores/>

Oster, Emily (2016). Unobservable Selection and Coefficient Stability: Theory and Evidence, *Journal of Business & Economic Statistics*, 37:2, 187-204, <https://doi.org/10.1080/07350015.2016.1227711>

Padula, W. V., Mishra, M. K., Makic, M. B. F., & Sullivan, P. W. (2011). Improving the Quality of Pressure Ulcer Care With Prevention: A Cost-Effectiveness Analysis. *Medical Care*, 49(4), 385–392. <http://www.jstor.org/stable/41103930>

Statistiska Centralbyrån, SCB (2023). Data on average population (medelfolkmängd) by age group 2013-2022, collected in April 2023.

<https://www.statistikdatabasen.scb.se/pxweb/sv/ssd/>

Senior Alert (2022). Sammanställning, Punktprevalensmätning av trycksår. 17 nov 2022.

<https://www.senioralert.se/resultat/ppm/>

Senior Alert (2023) 1. Resultat PPM kommun, 2017-2022. Data collected April 2023.

<https://www.senioralert.se/resultat/ppm/>

Senior Alert (2023) 2. Trycksår, För personal. Collected April 2023.

<https://www.senioralert.se/for-personal/trycksar/>

Senior Alert (2023) 3. Undernäring, För personal. Collected April 2023.

<https://www.senioralert.se/for-personal/undernaring/>

SFS (2001:453). Socialtjänstlag.

https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/socialtjanstlag-2001453_sfs-2001-453#K7

Socialstyrelsen (2022) 1. Trycksår, Samlat stöd för patientsäkerhet. Updated on 17-05-2022.

<https://patientsakerhet.socialstyrelsen.se/risker-och-varnskador/varnskador/trycksar/>

Socialstyrelsen (2022) 2. Statistik om socialtjänstinsatser till äldre och personer med funktionsnedsättning efter regiform. Updated on 09-03-2022.

<https://www.socialstyrelsen.se/statistik-och-data/statistik/alla-statistikammen/socialtjanstinsatser-till-aldre-och-personer-med-funktionsnedsattning-efter-regiform/>

Socialstyrelsen (2016). Din rätt till vård och omsorg- en vägvisare för äldre.

<https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/vagledning/2016-5-5.pdf>

Socialstyrelsen (2012). Kommunal eller enskild regi, spelar det någon roll? – en jämförelse av utförare av vård och omsorg om äldre. <https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/ovrigt/2012-5-30.pdf>

Socialstyrelsen (2021). Behov av och tillgång till särskilda boendeformer för äldre.

<https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/ovrigt/2021-1-7187.pdf>

Socialstyrelsen (2023) 1. Statistik om insatser enligt lagen om stöd och service till vissa funktionshindrade 2022.

<https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/statistik/2023-4-8480.pdf>

Socialstyrelsen (2023) 2. Öppna jämförelser av hemtjänst och särskilt boende. Data collected for 2017-2019 and 2022. Data collected in April 2022.

<https://www.socialstyrelsen.se/statistik-och-data/oppna-jamforelser/socialtjanst/aldreomsorg/hemtjanst-och-sarskilt-boende/>

Sveriges Kommuner och Regioner (SKR) (2022). Kommuner och regioner, Tjänster. Published 04-05-2022.

<https://skr.se/skr/tjanster/kommunerochregioner.431.html#:~:text=Kommunerna%20ansvarar%20of%C3%B6r%20en%20stor,frivilliga%20och%20beslutas%20av%20lokalpolitikerna.>

Upphandlingsmyndigheten 2023. Hitta LOV-uppdrag. Verksamhetsområde: Särskilt boende enl. SoL och Särskilt boende enl. LSS. Collected on 25-04-2023.

<https://www.upphandlingsmyndigheten.se/hitta-lov-uppdrag/>

Appendix

TABLE A1: Robustness checks on baseline results

VARIABLES	(1) Exclude pandemic years	(2) Exclude pandemic years	(3) Exclude LOV- municipalities	(4) Exclude LOV- municipalities
Private	-0.015** (0.006)	-0.012** (0.006)	-0.020*** (0.005)	-0.016*** (0.005)
Share with pressure sore risk		0.112*** (0.029)		0.119*** (0.029)
Share women		-0.008 (0.019)		-0.005 (0.018)
Share with BMI < 22		0.019 (0.024)		0.027 (0.029)
Constant	0.065*** (0.003)	0.032** (0.015)	0.064*** (0.002)	0.025* (0.014)
Observations	3,577	3,577	4,469	4,469
R-squared	0.008	0.052	0.009	0.060
Number of municipalities	285	285	259	259
Municipality FE:s	YES	YES	YES	YES
Year FE:s	YES	YES	YES	YES

Table A1- Robustness checks results, outcome variable “share of residents with pressure sores”. Analysis on unit-year level. Column 1 & 2 excluding 2020 and 2021 observations. Column 3 & 4 excluding 26 municipalities which implemented LOV for care homes. Municipality-and year fixed effects included. Dataset from the Senior Alert registry from 2017-2022. Clustered standard errors by municipality in parentheses *** p<0.01, ** p<0.05, * p<0.1.

TABLE A2: Robustness check only nursing homes

VARIABLES	(1) Excluding pandemic years	(2) Excluding pandemic years	(3) Exclude LOV- municipalities	(4) Exclude LOV- municipalities
Private	-0.014** (0.006)	-0.014** (0.006)	-0.021*** (0.004)	-0.023*** (0.005)
Share with pressure sore risk		0.080** (0.035)		0.031 (0.036)
Share women		0.026 (0.038)		0.016 (0.035)
Share with BMI < 22		0.090** (0.043)		0.116* (0.060)
Constant	0.071*** (0.003)	0.005 (0.035)	0.071*** (0.003)	0.021 (0.032)
Observations	1,898	1,898	2,290	2,290
R-squared	0.015	0.054	0.032	0.075
Number of municipalities	285	285	259	259
Municipality FE:s	YES	YES	YES	YES
Year FE:s	YES	YES	YES	YES

Table A2- Robustness check results, only nursing 1898 nursing home observations included. Year 2020 and 2021 excluded. Outcome variable share of residents with pressure ulcers, analysis on unit-year level. Municipality-and year fixed effects included. Datasets from the Senior Alert registry 2017-2022. Clustered standard errors by municipality in parentheses *** p<0.01, ** p<0.05, * p<0.1.

TABLE A3: Robustness checks- Excluding short-term homes

VARIABLES	(1) Exclude pandemic years	(2) Exclude pandemic years	(3) Exclude LOV- municipalities	(4) Exclude LOV- municipalities
Private	-0.007 (0.005)	-0.006 (0.005)	-0.013*** (0.005)	-0.011** (0.005)
Share with pressure sore risk		0.082*** (0.025)		0.097*** (0.032)
Share women		0.030 (0.020)		0.029 (0.025)
Share with BMI < 22		0.022 (0.023)		0.024 (0.038)
Constant	0.059*** (0.003)	0.010 (0.015)	0.059*** (0.002)	0.006 (0.016)
Observations	3,014	3,014	3,691	3,691
R-squared	0.006	0.045	0.008	0.057
Number of municipalities	285	285	259	259
Municipality FE:s	YES	YES	YES	YES
Year FE:s	YES	YES	YES	YES

Table A3- Robustness checks results, outcome variable “share of residents with pressure sores”. Analysis on unit-year level. Excluding all 874 short-term home observations. Column 1 & 2 excluding year 2020 and 2021. Column 3 & 4 excluding all 26 municipalities which implemented LOV for care homes. Municipality-and year fixed effects included. Dataset from the Senior Alert registry from 2017-2022. Clustered standard errors by municipality in parentheses *** p<0.01, ** p<0.05, * p<0.1.